

Vehicle-Tank Meters

Device Description: _____

Contact Name: _____ Phone: _____

Company: _____ Address: _____

E-mail: _____ City: _____

Instructions For Completing Pre-Evaluation Checklists

You will usually need to complete **both** the “General” checklist and the specific checklist which is most applicable to your device or system type. For example, for a weighing device or weighing system the “General” checklist (which applies to all device types) and the “Scales” checklist should be completed. Both the “General” and “Watthour Meter” checklists should be completed and submitted with an electric watthour metering system application.

The exceptions are the computer software/hardware component pre-evaluation checklists which have the “General” requirements incorporated in them. Use the checklist for computer systems connected with either scales or measuring systems. Only one pre-evaluation checklist will be needed unless the software will be connected to both types of systems

These checklists include requirements extracted from the California Code of Regulations. Though not all-encompassing, the checklists contain requirements beyond those which would apply to any single device type or accessory. It is best to think of a device type as a weighing or measuring device system or as a component of such a system whichever best describes the device(s).

When applying the requirements to your device you have three options; Check

YES	If your device or system complies
NO	if the device or system does not comply.
NA	if sections appear not to apply to the device or system type(s)

If selecting “**NO**”, consider if your device or system is ready for evaluation. If the deficiency is of such a nature that it will not effect the ability to test for accuracy, such as failure to conform with marking requirements or lack of provision for sealing, the evaluation can probably begin while deficiencies are being corrected.

If you are not able to conduct accuracy testing your system or device is probably not yet ready for an evaluation.

I have reviewed the enclosed specifications, tolerances, and test notes for the device type for which we have applied for evaluation and approval. To the best of my knowledge I have determined the device meets all applicable requirements.

Signed: _____

Date: _____

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A. Application.

A.1. This code applies to meters mounted on vehicle tanks including those used for the measurement and delivery of petroleum products or agri-chemical liquids such as fertilizers, feeds, pesticides, defoliants, and bulk deliveries of water.

A.2. This code does not apply to the following devices:

- (a) Devices used for dispensing liquefied petroleum gases or other liquids that do not remain in a liquid state at atmospheric pressures and temperatures.
- (b) Devices used solely for dispensing a product in connection with operations in which the amount dispensed does not affect customer charges.
- (c) Vehicle tanks used as measures.
- (d) Mass flow meters.

A.3. See also General Code requirements.

	Yes	No	NA
S. Specifications. S.1. Design of Indicating and Recording Elements and of Recorded Representations. S.1.1. Primary Elements. S.1.1.1. General. - A meter shall be equipped with a primary indicating element and may also be equipped with a primary recording element. [Note: Except for systems used solely for the sale of aviation fuel into aircraft and for aircraft-related operations, vehicle-tank meters shall be equipped with a primary recording element.			
S.1.1.2. Units. (a) A meter shall indicate, and record if the meter is equipped to record, its deliveries in terms of liters (gallons). Fractional parts of the liter (gallon) shall be in terms of either decimal or binary subdivisions. (b) When it is an industry practice to purchase and sell milk by weight based upon 1.03 kg/L (8.6 lb/gal), the primary indicating element may indicate in kilograms (pounds) and decimal kilograms (pounds). The weight value division shall be a decimal multiple or submultiple of 1, 2, or 5. (See S.5.5.)			
S.1.1.3. Value of Smallest Unit. - The value of the smallest unit of indicated delivery, and recorded delivery if the meter is equipped to record, shall not exceed the equivalent of: (a) 0.5 L (0.1 gal) or 0.5 kg (1 lb) on milk-metering systems (b) 0.5 L (0.1 gal) on meters with a rated maximum flow rate of 500 L/min (100 gal/min) or less used for retail deliveries of liquid fuel, or (c) 5 L (1 gal) on other meters.			

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	Yes	No	NA
<p>S.1.1.4. Advancement of Indicating and Recording Elements. - Primary indicating and recording elements shall be susceptible to advancement only by the mechanical operation of the meter. However, a meter may be cleared by advancing its elements to zero, but only if:</p> <p>(a) the advancing movement, once started, cannot be stopped until zero is reached, or</p> <p>(b) in the case of indicating elements only, such elements are automatically obscured until the elements reach the correct zero position.</p>			
<p>S.1.1.5. Return to Zero. - Primary indicating elements shall be readily returnable to a definite zero indication. Means shall be provided to prevent the return of primary indicating elements, and of primary recording elements if these are returnable to zero, beyond their correct zero position.</p>			
<p>S.1.2. Graduations.</p> <p>S.1.2.1. Length. - Graduations shall be so varied in length that they may be conveniently read.</p>			
<p>S.1.2.2. Width. - In any series of graduations, the width of a graduation shall in no case be greater than the width of the minimum clear interval between graduations, and the width of main graduations shall be not more than 50 percent greater than the width of subordinate graduations. Graduations shall in no case be less than 0.2 mm (0.008 in) wide.</p>			
<p>S.1.2.3. Clear Interval Between Graduations. - The clear interval shall be not less than 0.25 mm (0.10 in). If the graduations are not parallel, the measurement shall be made:</p> <p>(a) along the line of relative movement between the graduations at the end of the indicator, or</p> <p>(b) if the indicator is continuous, at the point of widest separation of the graduations.</p>			
<p>S.1.3. Indicators.</p> <p>S.1.3.1. Symmetry. - The index of an indicator shall be symmetrical with respect to the graduations at least throughout that portion of its length associated with the graduations.</p>			
<p>S.1.3.2. Length. - The index of an indicator shall reach to the finest graduations with which it is used, unless the indicator and the graduations are in the same plane, in which case the distance between the end of the indicator and the ends of the graduations, measured along the line of the graduations, shall be not more than 1.0 mm (0.04 in).</p>			
<p>S.1.3.3. Width. - The width of the index of an indicator in relation to the series of graduations with which it is used shall be not greater than:</p> <p>(a) the width of the widest graduation, and</p> <p>(b) the width of the minimum clear interval between graduations.</p> <p>When the index of an indicator extends along the entire length of a graduation, that portion of the index of the indicator that may be brought into coincidence with the graduation shall be of the same width throughout the length of the index that coincides with the graduation.</p>			
<p>S.1.3.4. Clearance. - The clearance between the index of an indicator and the graduations shall in no case be more than 1.5 mm (0.06 in).</p>			

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	Yes	No	NA
S.1.3.5. Parallax. - Parallax effects shall be reduced to the practicable minimum.			
S.1.3.6. Travel of Indicator. - If the most sensitive element of the primary indicating element utilizes an indicator and graduations, the relative movement of these parts corresponding to the smallest indicated value shall not be less than 5 mm (0.20 in).			
S.1.4. Computing-Type Device.			
S.1.4.1. Display of Unit Price. - In a device of the computing type, means shall be provided for displaying on the outside of the device, in a manner clear to the operator and an observer, the unit price at which the device is set to compute.			
S.1.4.2. Printed Ticket. - If a computing-type device issues a printed ticket which displays the total computed price, the ticket shall also have printed clearly thereon the total quantity of the delivery, the appropriate fraction of the quantity, and the price per unit of quantity.			
S.1.4.3. Money-Value Computations. - Money-value computations shall be of the full-computing type in which the money value at a single unit price, or at each of a series of unit prices, shall be computed for every delivery within either the range of measurement of the device or the range of the computing elements, whichever is less. Value graduations shall be supplied and shall be accurately positioned. The value of each graduated interval shall be 1 cent. On electronic devices with digital indications, the total price may be computed on the basis of the quantity indicated when the value of the smallest division indicated is equal to or less than 0.2 L (0.1 gal) or 0.2 kg (1 lb).			
S.1.4.4. Money Values, Mathematical Agreement. - Any digital money-value indication and any recorded money value on a computing-type device shall be in mathematical agreement with its associated quantity indication or representation to within 1 cent of money value.			
S.2. Design of Measuring Elements.			
S.2.1. Vapor Elimination. - A metering system shall be equipped with an effective vapor or air eliminator or other automatic means to prevent the passage of vapor and air through the meter. Vent lines from the air or vapor eliminator shall be made of metal tubing or some other suitable rigid material.			
S.2.2. Provision for Sealing. - Except on devices for metering milk, adequate provision shall be made for applying security seals in such a manner that no adjustment may be made of: (a) any measurement element, and (b) any adjustable element for controlling delivery rate when such rate tends to affect the accuracy of deliveries.			
S.2.2.1. Milk-Metering Systems. - Adequate provision shall be made for applying security seals to the adjustment mechanism and the register. The adjusting mechanism shall be readily accessible for purposes of affixing a security seal.			
S.2.3. Directional Flow Valves. - Valves intended to prevent reversal of flow shall be automatic in operation. However, on equipment used exclusively for fueling aircraft, such valves may be manual in operation.			

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	Yes	No	NA
S.3. Design of Discharge Lines and Discharge Line Valves. (Not applicable to milk-metering systems.)			
S.3.1. Diversion of Measured Liquid. - Except on equipment used exclusively for fueling aircraft, no means shall be provided by which any measured liquid can be diverted from the measuring chamber of the meter or the discharge line therefrom. However, two or more delivery outlets may be installed if means is provided to insure that: <ul style="list-style-type: none"> (a) liquid can flow from only one such outlet at one time, and (b) the direction of flow for which the mechanism may be set at any time is definitely and conspicuously indicated. 			
S.3.2. Pump-Discharge Unit. - On a pump-discharge unit, the discharge hose shall be of the wet-hose type with a shutoff valve at its outlet end. However, a pump-discharge unit may be equipped also with a dry hose without a shutoff valve at its outlet end, but only if: <ul style="list-style-type: none"> (a) the dry hose is as short as practicable, and (b) there is incorporated in the discharge piping, immediately adjacent to the meter, effective means to insure that liquid can flow through only one of the discharge hoses at any one time and that the meter and the wet hose remain full of liquid at all times. 			
S.3.3. Gravity-Discharge Unit. - On a gravity-discharge unit, the discharge hose or equivalent pipe shall be of the dry-hose type with no shutoff valve at its outlet end. The dry hose shall be of such stiffness and only of such length as to facilitate its drainage. The inlet end of the hose or of an equivalent outlet pipe shall be of such height as to provide for proper drainage of the hose or pipe. There shall be incorporated an automatic vacuum breaker or equivalent means to prevent siphoning and to insure the rapid and complete drainage.			
S.3.4. Discharge Hose. - A discharge hose shall be adequately reinforced.			
S.3.5. Discharge Valve. - A discharge valve may be installed in the discharge line only if the device is of the wet-hose type, in which case such valve shall be at the discharge end of the line. Any other shutoff valve on the discharge side of the meter shall be of the automatic or semiautomatic predetermined-stop type or shall be operable only: <ul style="list-style-type: none"> (a) by means of a tool (but not a pin) entirely separate from the device, or (b) by mutilation of a security seal with which the valve is sealed open. 			
S.3.6. Antidrain Valve. - In a wet-hose, pressure-type device, an effective antidrain valve shall be incorporated in the discharge valve or immediately adjacent thereto. The antidrain valve shall function so as to prevent the drainage of the discharge hose. However, a device used exclusively for fueling and defueling aircraft may be of the pressure type without an antidrain valve.			
S.4. Design of Intake Lines (for Milk-Metering Systems).			
S.4.1. Diversion of Liquid to be Measured. - No means shall be provided by which any liquid can be diverted from the supply tank to the receiving tank without being measured by the device.			

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	Yes	No	NA
S.4.2. Intake Hose. - The intake hose shall be: (a) of the dry-hose type; (b) adequately reinforced; (c) not more than 6 m (20 ft) in length, unless it can be demonstrated that a longer hose is essential to permit pickups from a supply tank; and (d) connected to the pump at horizontal or above, to permit complete drainage of the hose.			
S.5. Marking Requirements S.5.1. Limitation of Use. - If a meter is intended to measure accurately only liquids having particular properties, or to measure accurately only under specific installation or operating conditions, or to measure accurately only when used in conjunction with specific accessory equipment, these limitations shall be clearly and permanently stated on the meter.			
S.5.2. Discharge Rates. - A meter shall be marked to show its designed maximum and minimum discharge rates. However, the minimum discharge rate shall not exceed 20 percent of the maximum discharge rate.			
S.5.3. Measuring Components Milk-Metering System. - All components that affect the measurement of milk that are disassembled for cleaning purposes shall be clearly and permanently identified with a common serial number.			
S.5.4. Flood Volume, Milk-Metering System. - When applicable, the volume of product necessary to flood the system when dry shall be clearly, conspicuously, and permanently marked on the air eliminator.			
S.5.5. Conversion Factor. - When the conversion factor of 1.03 kg/L (8.6 lb/gal) is used to convert the volume of milk to weight, the conversion factor shall be clearly marked on the primary indicating element and recorded on the delivery ticket.			
N. Notes. N.1. Test Liquid. (a) A measuring system shall be tested with the liquid to be commercially measured or with a liquid of the same general physical characteristics. Following a satisfactory examination, the weights and measures official should attach a seal or tag indicating the product used during the test. (b) A milk measuring system shall be tested with the type of milk to be measured when the accuracy of the system is affected by the characteristics of milk (e.g., positive displacement meters).			
N.2. Evaporation and Volume Change. - Care shall be exercised to reduce to a minimum, evaporation losses and volume changes resulting from changes in temperature of the test liquid.			
N.3. Test Drafts. - Test drafts should be equal to at least the amount delivered by the device in 1 minute at its maximum discharge rate, and shall in no case be less than 180 L (50 gal) or 225 kg (500 lb).			

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	Yes	No	NA
N.4. Testing Procedures.			
N.4.1. Normal Tests. - The "normal" test of a measuring system shall be made at the maximum discharge rate that may be anticipated under the conditions of the installation. Any additional tests conducted at flow rates down to and including one-half of the sum of the maximum discharge flow rate and the rated minimum discharge flow rate shall be considered normal tests.			
N.4.1.1. Milk Measuring System. - The "normal" test shall include a determination of the effectiveness of the air elimination system.			
N.4.2. Special Tests (Except Milk-Measuring Systems). - "Special" tests shall be made to develop the operating characteristics of a measuring system and any special elements and accessories attached to or associated with the device. Any test except as set forth in N.4.1. shall be considered a special test. Special test of a measuring system shall be made as follows: (a) at a minimum discharge rate of 20 percent of the marked maximum discharge rate or at the minimum discharge rate marked on the device whichever is less; (b) to develop operating characteristics of the measuring system during a split-compartment delivery.			
N.4.3. Antidrain Valve Test. - The effectiveness of the antidrain valve shall be tested after the pump pressure in the measuring system has been released and a valve between the supply tank and the discharge valve is closed.			
N.4.4. System Capacity. - The test of a milk-measuring system shall include the verification of the volume of product necessary to flood the system as marked on the air eliminator.			
T. Tolerances.			
T.1. Application.			
T.1.1. To Underregistration and to Overregistration. - The tolerances hereinafter prescribed shall be applied to errors of underregistration and errors of overregistration.			
T.2. Tolerance Values. - Maintenance and acceptance tolerances shall be as shown in Tables 1, 2, 3, and 4 (see pages 8 and 9).			
T.3. Tolerance Values on Meters used for the Measurement of Agri-Chemical Liquids. - The maintenance tolerance on normal and special tests shall be 1 percent of the indicated quantity. The acceptance tolerance on a normal test shall be 0.5 percent of the indicated quantity and on special tests, 1 percent of the indicated quantity.			
T.4. Repeatability. - When multiple tests are conducted at approximately the same flow rate, the range of the test results for the flow rate shall not exceed 40 percent of the applicable tolerance.			

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Table 1 Tolerances for Vehicle-Tank Meters Except for Vehicle-Mounted Milk Meters, Agri-Chemical Meters, and Water Meters			
	Normal Tests		Special Tests
Indication	Maintenance Tolerance	Acceptance Tolerance	Maintenance and Acceptance Tolerance
(Gallons)	(Cubic inches)	(Cubic inches)	(Cubic inches)
50	50	25	50
Over 50	Add 1/2 cubic inch per Indicated gallon over 50	Add 1/4 cubic inch per Indicated gallon over 50	Add 1 cubic inch per indicated gallon over 50

Table 2 Tolerances for Vehicle-Mounted Milk Meters		
Indication	Maintenance	Acceptance
Gallons	gallons	gallons
100	0.5	0.3
200	0.7	0.4
300	0.9	0.5
400	1.1	0.6
500	1.3	0.7
Over 500	Add 0.002 gallon per indicated gallon over 500	Add 0.001 gallon per indicated gallon over 500

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Table 3 Tolerances for Vehicle-Mounted Water Meters Normal Tests				
Meter size (inches)	Rate of flow (gal/min)	Maximum Rate		
		Meter indication		Tolerance on over- and under-registration
		gal	ft ³	
5/8	15	50	5	1.5%
3/4	25	50	5	
1	40	100	10	
1 1/2	80	300	40	
2	120	500	40	
3	250	500	50	
4	350	1 000	100	
6	700	1 000	100	

Table 4 Tolerances for Vehicle-Mounted Water Meters Special Tests									
Meter size (inches)	Intermediate Rate				Minimum Rate				
	Rate of flow (gal/min)	Meter indication		Tolerance on over- and under- registration	Rate of flow (gal/min)	Meter indication		Tolerance	
		gal	ft ³			gal	ft	Under- registration	Over- registration
5/8	2	10	1	1.5%	1/4	5	1	5.0%	1.5%
3/4	3	10	1		1/2	5	1		
1	4	10	1		3/4	5	1		
1 1/2	8	50	5		1 1/2	10	1		
2	15	50	5		2	10	1		
3	20	50	5		4	10	1		
4	40	100	10		7	50	5		
6	60	100	10		12	50	5		